CS 452

Homework 1 – VLSM (Variable Length Subnet Masking)

For each subnet, please answer to the following questions below. Please make sure to give both the 32 binary number and the dotted decimal notation.

Given:

IP address 193.2.3.0/24

- AtlantaHQ: 58 hosts
- PerthHQ: 26 hosts
- SydneyHQ: 10 hosts
- CorpusHQ:10 hosts
- WAN1: 2 IP addresses
- WAN2: 2 IP addresses
- WAN3: 2 IP addresses

Question 1. How many bits need to be used for a host id?

AtlantaHQ: 58 hosts

$2^6 = 64 - 2$ (can't use all 0's and all 1's) = 62 > 58 ∴ 6 bits is used for host ID

PerthHQ: 26 hosts

$2^5 = 32 - 2$ (can't use all 0's and all 1's) = 30 > 26 ∴ 5 bits is used for host ID

SydneyHQ: 10 hosts

$2^4 = 16 - 2$ (can't use all 0's and all 1's) = 14 > 10 ∴ 4 bits is used for host ID

CorpusHQ: 10 hosts

$2^4 = 16 - 2$ (can't use all 0's and all 1's) = 14 > 10 ∴ 4 bits is used for host ID

WAN1: 2 IP addresses

$2^2 = 4 - 2$ (can't use all 0's and all 1's) = 2 = 2 ∴ 2 bits is used for host ID

WAN2: 2 IP addresses

$2^2 = 4 - 2$ (can't use all 0's and all 1's) = 2 = 2 ∴ 2 bits is used for host ID

WAN3: 2 IP addresses

$2^2 = 4 - 2$ (can't use all 0's and all 1's) = 2 = 2 ∴ 2 bits is used for host ID

Question 2. How many bits need to be used for a subnet id?

AtlantaHQ: 58 hosts

Host ID = 6 bits, Subnet ID = 8 bits – Host ID = 2 bits ∴ 2 bits is used for Subnet ID

PerthHQ: 26 hosts

Host ID = 5 bits, Subnet ID = 8 bits – Host ID = 3 bits ∴ 3 bits is used for Subnet ID

SydneyHQ: 10 hosts

Host ID = 4 bits, Subnet ID = 8 bits – Host ID = 4 bits ∴ 4 bits is used for Subnet ID

CorpusHQ: 10 hosts

Host ID = 4 bits, Subnet ID = 8 bits – Host ID = 4 bits ∴ 4 bits is used for Subnet ID

WAN1: 2 IP addresses

Host ID = 2 bits, Subnet ID = 8 bits – Host ID = 6 bits ∴ 6 bits is used for Subnet ID

WAN2: 2 IP addresses

Host ID = 2 bits, Subnet ID = 8 bits – Host ID = 6 bits ∴ 6 bits is used for Subnet ID

WAN3: 2 IP addresses

Host ID = 2 bits, Subnet ID = 8 bits – Host ID = 6 bits ∴ 6 bits is used for Subnet ID

Question 3. What is the subnet id?

AtlantaHQ: 58 hosts, Subnet bits 2, Host bits 6 — Subnet ID: 00

PerthHQ: 26 hosts, Subnet bits 3, Host bits 5 — Subnet ID: 010

SydneyHQ: 10 hosts, Subnet bits 4, Host bits 4 — Subnet ID: 0110

CorpusHQ: 10 hosts, Subnet bits 4, Host bits 4 — Subnet ID: 0111

WAN1: 2 IP addresses, Subnet bits 6, Host bits 2 — Subnet ID: 100000

WAN2: 2 IP addresses, Subnet bits 6, Host bits 2 — Subnet ID: 100001

WAN3: 2 IP addresses, Subnet bits 6, Host bits 2 — Subnet ID: 100010

Question 4. What is the IP address for the 1st usable host id in the subnet?

AtlantaHQ: 58 hosts, Subnet bits 2, Host bits 6

Subnet ID: 00 Host ID: 000001 (can't use 000000 because that is saved for THIS)

00000001 = 1

IP address is 193.2.3.1/26 (26 because net ID and subnet ID go to 26 bits)

32-bit address 11000001 00000010 00000011 00000001

PerthHQ: 26 hosts, Subnet bits 3, Host bits 5

Subnet ID: 010 Host ID: 00001 (can't use 00000 because that is saved for THIS)

01000001 = 65

IP address is 193.2.3.65/27 (27 because net ID and subnet ID go to 27 bits)
32-bit address 11000001 00000010 00000011 01000001

SydneyHQ: 10 hosts, Subnet bits 4, Host bits 4

Subnet ID: 0110 Host ID: 0001 (can't use 0000 because that is saved for THIS)

01100001 = 97

IP address is 193.2.3.97/28 (28 because net ID and subnet ID go to 28 bits)
32-bit address 11000001 00000010 00000011 01100001

CorpusHQ: 10 hosts, Subnet bits 4, Host bits 4

Subnet ID: 0111 Host ID: 0001 (can't use 0000 because that is saved for THIS)

01110001 = 113

IP address is 193.2.3.113/28 (28 because net ID and subnet ID go to 28 bits)
32-bit address 11000001 00000010 00000011 01110001

WAN1: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet ID: 100000 Host ID: 01 (can't use 00 because that is saved for THIS)

10000001 = 129

IP address is 193.2.3.129/30 (30 because net ID and subnet ID go to 30 bits)
32-bit address 11000001 00000010 00000011 10000001

WAN2: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet ID: 100001 Host ID: 01 (can't use 00 because that is saved for THIS)

10000101 = 133

IP address is 193.2.3.133/30 (30 because net ID and subnet ID go to 30 bits)
32-bit address 11000001 00000010 00000011 10000101

WAN3: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet ID: 100010 Host ID: 01 (can't use 00 because that is saved for THIS)

10001001 = 137

IP address is 193.2.3.137/30 (30 because net ID and subnet ID go to 30 bits)
32-bit address 11000001 00000010 00000011 10001001

Question 5. What is the IP address of the last useable host id in the subnet?

AtlantaHQ: 58 hosts, Subnet bits 2, Host bits 6

Subnet ID: 00 Host ID: 111110 (can't use 111111 because that is saved for Broadcast)

00111110 = 62

IP address is 193.2.3.62/26 (26 because net ID and subnet ID go to 26 bits)

32-bit address 11000001 00000010 00000011 00111110

PerthHQ: 26 hosts, Subnet bits 3, Host bits 5

Subnet ID: 010 Host ID: 11110 (can't use 11111 because that is saved for Broadcast)

01011110 = 94

IP address is 193.2.3.94/27 (27 because net ID and subnet ID go to 27 bits)

32-bit address 11000001 00000010 00000011 01011110

SydneyHQ: 10 hosts, Subnet bits 4, Host bits 4

Subnet ID: 0110 Host ID: 1110 (can't use 1111 because that is saved for Broadcast)

01101110 = 110

IP address is 193.2.3.110/28 (28 because net ID and subnet ID go to 28 bits)

32-bit address 11000001 00000010 00000011 01101110

CorpusHQ: 10 hosts, Subnet bits 4, Host bits 4

Subnet ID: 0111 Host ID: 1110 (can't use 1111 because that is saved for Broadcast)

01111110 = 126

IP address is 193.2.3.126/28 (28 because net ID and subnet ID go to 28 bits)

32-bit address 11000001 00000010 00000011 01111110

WAN1: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet ID: 100000 Host ID: 10 (can't use 11 because that is saved for Broadcast)

10000010 = 130

IP address is 193.2.3.130/30 (30 because net ID and subnet ID go to 30 bits)

32-bit address 11000001 00000010 00000011 10000010

WAN2: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet ID: 100001 Host ID: 10 (can't use 11 because that is saved for Broadcast)

10000110 = 134

IP address is 193.2.3.134/30 (30 because net ID and subnet ID go to 30 bits)

32-bit address 11000001 00000010 00000011 10000110

WAN3: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet ID: 100010 Host ID: 10 (can't use 11 because that is saved for Broadcast)

10001010 = 138

IP address is 193.2.3.138/30 (30 because net ID and subnet ID go to 30 bits)

32-bit address 11000001 00000010 00000011 10001010

Question 6. What is the broadcasting IP address for the subnet?

AtlantaHQ: 58 hosts, Subnet bits 2, Host bits 6

Subnet ID: 00 Host ID: 111111 **00**111111 = 63

IP address is 193.2.3.63/26 (26 because net ID and subnet ID go to 26 bits)

32-bit address 11000001 00000010 00000011 00111111

PerthHQ: 26 hosts, Subnet bits 3, Host bits 5

Subnet ID: 010 Host ID: 11111 **010**11111 = 95

IP address is 193.2.3.95/27 (27 because net ID and subnet ID go to 27 bits)

32-bit address 11000001 00000010 00000011 01011111

SydneyHQ: 10 hosts, Subnet bits 4, Host bits 4

Subnet ID: 0110 Host ID: 1111 **0110**1111 = 111

IP address is 193.2.3.111/28 (28 because net ID and subnet ID go to 28 bits)

32-bit address 11000001 00000010 00000011 01101111

CorpusHQ: 10 hosts, Subnet bits 4, Host bits 4

Subnet ID: 0111 Host ID: 1111 **0111**1111 = 127

IP address is 193.2.3.127/28 (28 because net ID and subnet ID go to 28 bits)

32-bit address 11000001 00000010 00000011 01111111

WAN1: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet ID: 100000 Host ID: 11 **100000**11 = 131

IP address is 193.2.3.131/30 (30 because net ID and subnet ID go to 30 bits)

32-bit address 11000001 00000010 00000011 10000011

WAN2: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet ID: 100001 Host ID: 11 **100001**11 = 135

IP address is 193.2.3.135/30 (30 because net ID and subnet ID go to 30 bits)

32-bit address 11000001 00000010 00000011 10000111

WAN3: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet ID: 100010 Host ID: 11 **10001011** = 139

IP address is 193.2.3.139/30 (30 because net ID and subnet ID go to 30 bits)
32-bit address 11000001 00000010 00000011 10001011

Question 7. What is the subnet mask for the subnet?

AtlantaHQ: 58 hosts, Subnet bits 2, Host bits 6

Subnet Mask all 1's for net ID and subnet ID and 0's for host ID

Subnet Mask IP Address is 255.255.255.192/30 (30 because net ID and subnet ID go to 30 bits)
32-bit address 11111111 11111111 11111111 11000000

PerthHQ: 26 hosts, Subnet bits 3, Host bits 5

Subnet Mask all 1's for net ID and subnet ID and 0's for host ID

Subnet Mask IP Address is 255.255.255.224/30 (30 because net ID and subnet ID go to 30 bits)
32-bit address 11111111 11111111 11111111 11100000

SydneyHQ: 10 hosts, Subnet bits 4, Host bits 4

Subnet Mask all 1's for net ID and subnet ID and 0's for host ID

Subnet Mask IP Address is 255.255.255.240/30 (30 because net ID and subnet ID go to 30 bits)
32-bit address 11111111 11111111 11111111 11110000

CorpusHQ: 10 hosts, Subnet bits 4, Host bits 4

Subnet Mask all 1's for net ID and subnet ID and 0's for host ID

Subnet Mask IP Address is 255.255.255.240/30 (30 because net ID and subnet ID go to 30 bits)
32-bit address 11111111 11111111 11111111 11110000

WAN1: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet Mask all 1's for net ID and subnet ID and 0's for host ID

Subnet Mask IP Address is 255.255.255.252/30 (30 because net ID and subnet ID go to 30 bits)
32-bit address 11111111 11111111 11111111 11111100

WAN2: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet Mask all 1’s for net ID and subnet ID and 0’s for host ID

Subnet Mask IP Address is 255.255.255.252/30 (30 because net ID and subnet ID go to 30 bits)

32-bit address 11111111 11111111 11111111 11111100

WAN3: 2 IP addresses, Subnet bits 6, Host bits 2

Subnet Mask all 1’s for net ID and subnet ID and 0’s for host ID

Subnet Mask IP Address is 255.255.255.252/30 (30 because net ID and subnet ID go to 30 bits)

32-bit address 11111111 11111111 11111111 11111100